

Flyback RCDZR snubber

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Existing flyback primary side snubbers

A flyback primary side snubber protects the MOSFET while turn OFF. In addition, it helps for controlling the EMI and efficiency.

There are mainly two types of existing primary side snubber circuits.

1- RCD snubber

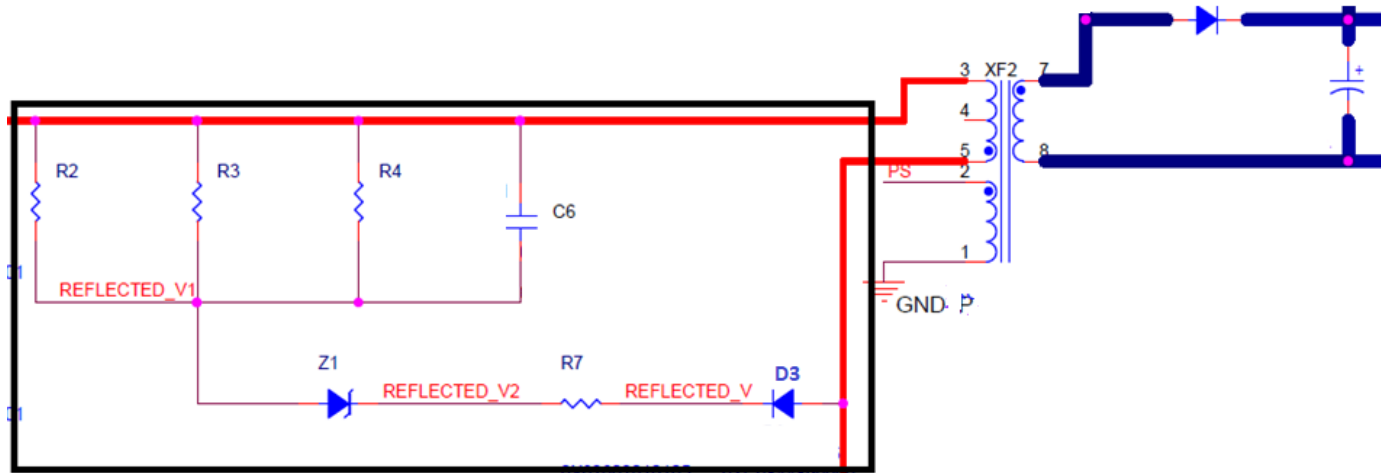
2-ZD snubber (Zener diode snubber)

RCD snubber: It is a simple snubber. It absorbs the current in the leakage inductor by turning ON the snubber diode when V_{ds} exceeds $V_{in} + nV_o$ (Input voltage + reflected voltage).

RCD snubber loads the flyback transformer while turning OFF the MOSFET which causes for distortion in the sense voltage. In addition, it leads to unstable output in some of the Primary Side Regulation (PSR) controller.

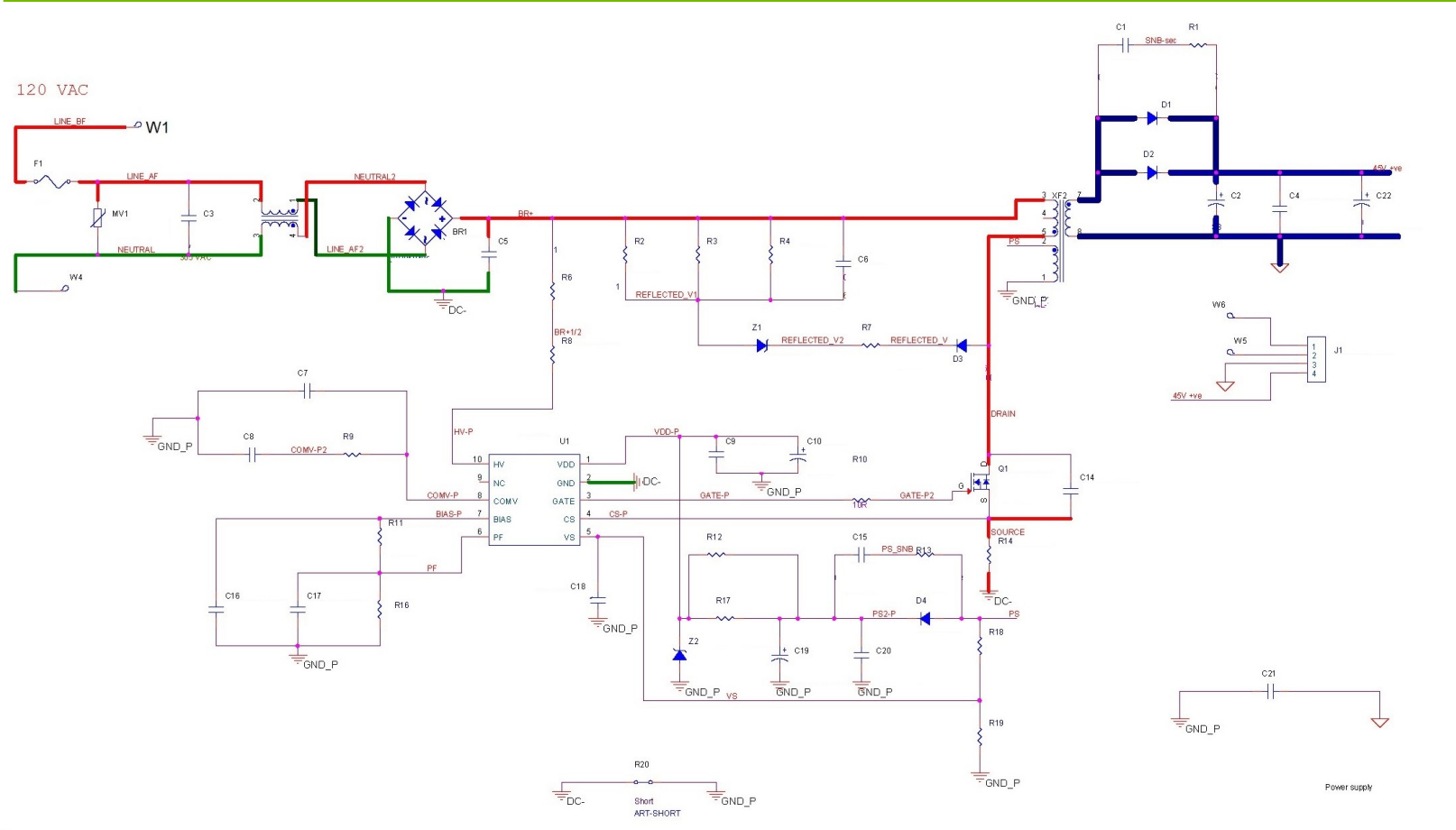
ZD snubber : A Zener diode (ZD) snubber replaces resistor/capacitor elements in a circuit with a Zener diode. When the MOSFET turns off, the drain voltage rises to the point that the Zener diode conducts to discharge the leakage inductance across the transformer. The ZD snubber produces high frequency ringing waveforms while turning ON the Zener diode which will affect EMI performance. Certain PSR controllers do not work properly with ZD snubbers.

Proposal : Primary side RCDZR snubber



An RCDZR snubber is proposed which consists of Zener (Z1), diode (D3), resistors (R2,R3, and R4),capacitor (C6) and resistor (R7). The RCDZR snubber protects a flyback MOSFET when the flyback MOSFET is turned off. When the MOSFET turns OFF, the drain voltage rises to the point that the Zener (Z1) conduct to discharge the energy stored in the leakage inductance of the transformer. The snubber does not conduct until the MOSFET voltage is higher than the Z1 breakdown voltage during turn OFF. This snubber helps to avoid loading the transformer during MOSFET turn OFF. In addition, the primary side sensing controller gets proper feedback voltage. In addition, the snubber also helps for improving the system efficiency. The resistors (R2,R3,R4,C6, and R7) help to smooth the MOSFET turn OFF by eliminating the ringing while Z1 turns ON. As such, the EMI performance will better with RCSZR snubber.

Primary side RCDZR snubber circuit



Advantage: primary side RCDZR snubber

1. Stable output voltage for PSR (primary side regulation) flyback converters
2. Can eliminate complicated transformer winding patterns to improve the stability
3. Better EMI performance than ZD snubber
4. Better efficiency than RC snubber

Full Schematic

